VASCULAR FLORA OF OSSIPEE LAKE, NEW HAMPSHIRE AND ITS SHORELINE

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Ossipee Lake, occupying 3091 acres in the towns of Ossipee, Freedom, and Effingham, County of Carroll, is the eighth largest lake in the State of New Hampshire. It is in the Saco River watershed with all water flowing into the Saco River through the Ossipee River. The lake has three bays — Broad, Leavitt and Berry Bays — associated with it. The elevation of the lake is 406 feet and it has a maximum depth of 61 feet. The greatest depth in the bays is 72 feet in Broad Bay. Newell (1960) in extensive studies reports the pH range of the lake between 6.0 and 6.4. The akalinity, Methyl Orange ppm., ranged between 6 and 11. This author has observed water temperatures along the lake shore to range from 70° - 80° during the summer.

Newell (1960) notes 600 acres of shoal at the southeast end of the lake. This area has a maximum depth of approximately eight feet. The shores are 94% wooded, 5% swampy, and 1% meadow. The bottom is 35% muck, 15% rock, and 50% sand.

Emergent and submerged vegetation was reported as scant (Newell, 1960). Observations by this author confirm this for most of the lake but where emergent vegetation is common (Pine River, Meadow Cove and other isolated coves) there is abundant submerged and floating vegetation.

Sampling was conducted at Ossipee Lake and its tributaries, including Pine River to Route 25, Bearcamp River to Route 16, Branch Brook, Hoyt Brook and the Danforth Ponds. All of the mentioned rivers are inlets to the lake. Observations and collections were made along the shores and in the water. The main areas where studies were made are indicated on the accompanying map. The collection period was the summer and autumn of the years 1968-1970. Vouchers have been deposited in the author's personal herbarium and various specimens have also been deposited in

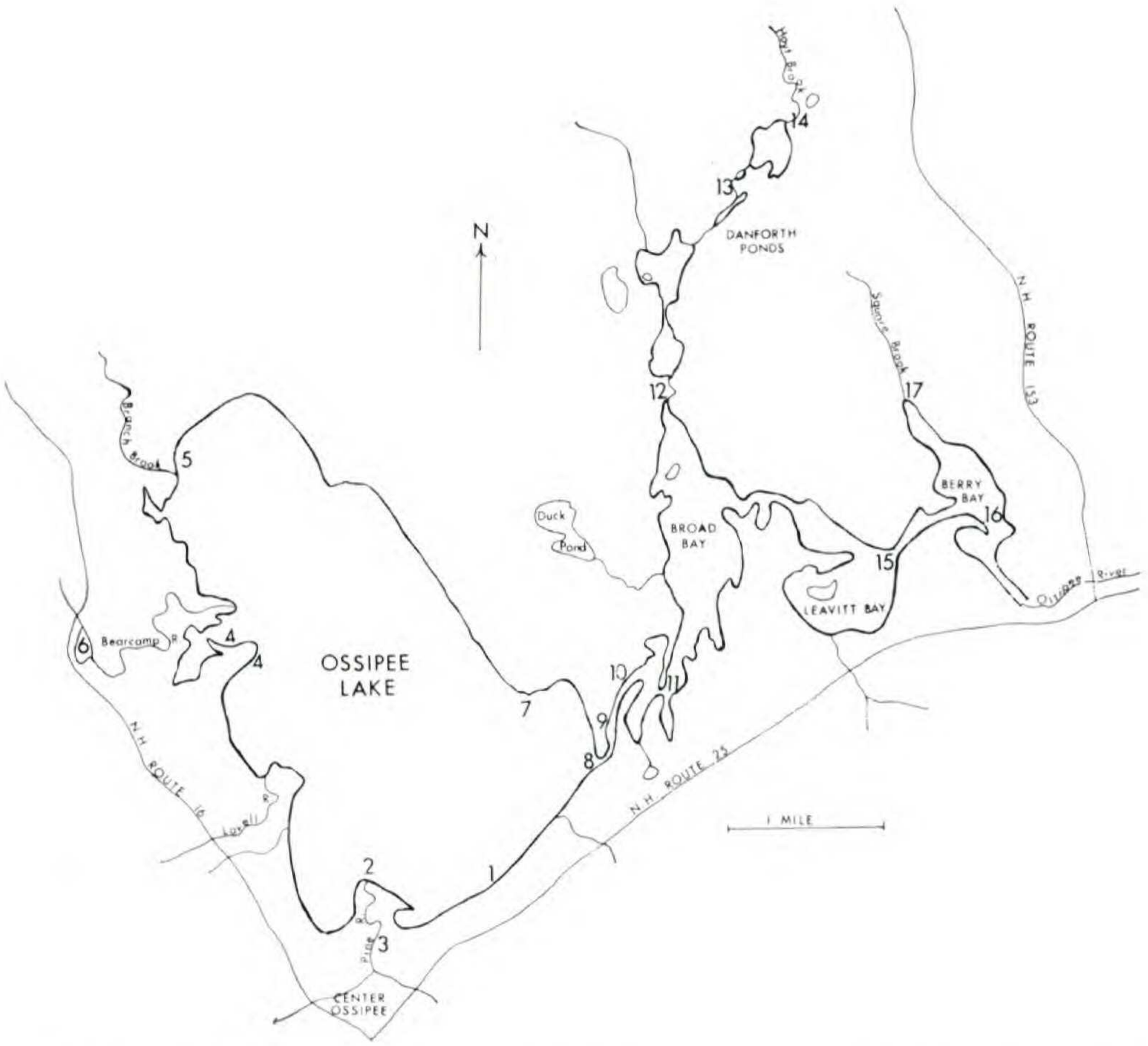

Figure 1. Map of Ossipee Lake and tributaries showing sites of collections.

the Boston State College Herbarium and the University of New Hampshire Herbarium.

Station 1 is located on the south shore of Ossipee Lake along the stretch of shoreline known as Long Sands. Much of this tract is to be developed by the State of New Hampshire for a future state park. This area consists of a fine white sand on the shore and in the water. Sedges and reeds are prevalent. One interesting phenomenon along this south shore is the occurrence of a small sphagnum peat area.

Station 2 is at the mouth of the Pine River. The shore is much the same as the south side of the lake. There is a variance in temperature of approximately 15°F between the lake and the river. The vegetation of this area is mainly composed of submerged and floating aquatics.

Pine River is a deep, cold, slowly flowing river with wooded shores. Going south on the river toward New Hampshire Route 25 is the location of Station 3. At the river bends there are sandy shore areas on the inside of the turns where emergent aquatics are found.

Two stations are located on the western shore of the lake. Station 4 is at the Meadow — Deer Cove area. The shore is sandy with many sedges and rushes growing along the lake margin. This side of the lake is deeper; thus the floral zone does not extend as far out into the lake as other sites. A small stream flows into the lake at the point between the two coves producing a swampy area. At the western end of Meadow Cove is a large flooded meadow.

Station 5 is at the northwestern end of the lake near the mouth of Branch Brook. The shoreline is composed of sedges growing in a sandy environment. Submerged vegetation is not common in this area.

The Bearcamp River near New Hampshire Route 16 is Station 6. This area is easily reached by boat from the lake. The river was rerouted at Route 16 so a backwater has resulted. The location is very swampy and much silt has filled in the backwater. The rerouted river is shallow, flows slowly, and has a sandy bottom. Water temperature varies considerably. The river is approximately 10° - 15°F colder than the backwater. Emergent and submerged aquatics are very common in the stagnant area. Along the river edge submerged plants are common.

The northeastern portion of Ossipee Lake is subjected to much wind and wave action. The shore is basically rocky without any sandy beaches. Aquatics are not common except at one shallow area; therefore no station was established in this section of the lake.

Further south, Station 7 was located at the area known as Pauli Point. This area consists of the large shoal area in the lake and the protected sandy shore facing south from Pauli Point. Much of this area has since been destroyed by the construction of a campground.

One of the most productive areas for pond weeds is Station 8, located at the mouth of the channel to Broad Bay.

The water is approximately six to eight feet deep with a strong current. Plants are particularly abundant where the water is two to six feet deep.

The channel from the lake to Broad Bay has many small coves. Pickerel Cove is sample Station 9. This cove and the one to the west comprise the sample area. The shore is sandy and also has a damp grassy environment. The bottom is a combination of sand and mud. Probably the greatest variety of plants is to be found here.

Further down the channel sampling was conducted at Station 10. The shore area is sandy. This region was disturbed when bulldozing once occurred for houselots. The sand was pushed into the water here, changing the habitat from a wooded area.

The area at the southwestern end of Broad Bay is Station 11. Deep water and shoal areas combine to make this an interesting habitat for submerged and floating plants.

The north end of Broad Bay including the mouth of the river flowing from lower Danforth Pond or Bay is Station 12. The shoreline is comprised of both wooded and sandy areas. Along the shore are many emergent plants and sedges, while submerged aquatics are common in the water. This area is occupied by Bayview Marina, so plants here are subjected to greater exposure to oil and gasoline.

The next two areas are in Danforth Pond (or Danforth Bay as it is sometimes referred to) and Hoyt Brook. Hoyt Brook flows between the three ponds and Broad Bay. Station 13 was situated on the brook between middle and upper Danforth Ponds. The stream is shallow at the southern end, while it ranges up to six feet in depth above the beaver dam. Water flow is slow and the water temeprature is high. The river is clogged with submerged and floating vegetation. The floating plants are found mainly along the periphery of the stream while submerged plants are in the middle of the stream as well as on the periphery.

Upper Danforth Pond (Goodwin Pond) is the site of the last collection area (Station 14) in this tributary. This area is at the northern end where a small stream flows into the pond. The water is approximately 15° - 20°F colder in

the stream than in the pond. The vegetation was very abundant in all forms.

Station 15 is located in Leavitt Bay. It is at the outlet of the bay leading to the channel which flows into Berry Bay. At this station only deep water aquatics were collected. At the other end of the channel, at the south end of Berry Bay, Station 16 is located. Only deep water specimens were observed here, also.

The north end of Berry Bay near the mouth of Square Brook is the final check point (Station 17). Collecting here was done basically in the shallow water along the shore and on the sandy shore.

Many plants are not mentioned as occurring at places where they, in fact, do occur. This is due to the fact that they may have been so common in the lake as a whole that no particular attention was paid to them in the collecting and observation.

Two plants found at Ossipee Lake have been reported only at this location in the State of New Hampshire. These are *Proserpinaca pectinata* Lam. (Seymour, 1966) and *Rhynchospora capillacea* Torr. (Seymour, 1963). *Proserpinaca pectinata* Lam. is found on the south shore at Station 1 in shallow water approximately six inches deep. It is also found in the damp sphagnum area at the same station. *Rhynchospora capillacea* Torr. was reported from Berry Bay but was not in a study area and was not found.

Seymour (1963) reported *Potamogeton nodosus* Poir. in the area of the Pine River mouth in association with *Potamogeton gramineus* L. This species was extensively searched for, but to no avail. *Potamogeton gramineus* var. *maximus* Morong was found in association with *Potamogeton pulcher* Tuckerm., *Potamogeton epihydrus* Raf. var. *Nuttallii* (C. & S.) Fern. and *Potamogeton natans* L.

Fassett (1966) was used as the criterion for the identification of the aquatics. Some plants are included in this survey which Fassett does not consider aquatics. These are included because they were growing along with the aquatics. In the following list, plants referred to as emergent are found at least part of the year partially in the

water. During the late summer the lake level lowers, so many of these plants are out of the water. Submerged plants are found below the water surface. Floating plants have part of the plant floating on the surface.

Nomenclature used is that of Fernald, (1950). The assistance of Dr. Albion Hodgdon of the University of New Hampshire for identfication of many of the grasses, sedges and rushes is gratefully acknowledged.

Isoetes Tuckermani A. Br. — Station 4[1] — submerged, found floating along western shore where it had been uprooted.

Osmunda regalis L. — 1, 3, 13 — emergent, on sandy shore and damp river edges.

Sparganium angustifolium Michx. — 4 — submerged, floating in quiet water, probably more common than observed.

S. americanum Nutt. — 6, 9, 13 — emergent, floating, along sandy and muddy margins.

Potamogeton Robbinsii Oakes — 11, 13, 14 — submerged, specimens found were floating loose just under the surface.

P. Berchtoldii Fieber var. *tenuissimus* (Mert. & Koch) Fern. — 3, 9 — submerged, in slow backwater of rivers and coves.

P. Spirillus Tuckerm. — 3, 6, 12, 13 — submerged, floating, common, usually along shallow shores in water up to four feet.

P. capillaceus Poir. — 3, 12, 13 — submerged, in shallow water.

P. epihydrus Raf. var. *Nuttallii* (C. & S.) Fern. — 2, 3, 8, 11, 13 — submerged, floating, common, in deep water.

P. amplifolius Tuckerm. — 2, 11, 13, 14 — submerged, floating, in slow current.

P. pulcher Tuckerm. — 2, 7, 8, 15 — submerged, floating, common in deep areas near river mouths.

P. gramineus L. var. *gramineus* — 2, 3, 8, 15, 16 — submerged, floating, common in deep water.

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[1]Stations are cited by number (see text and map).

P. gramineus L. var. *maximus* Morong — 3 — submerged, floating, in deep water.

P. gramineus L. var. *myriophyllus* Robbins — 2, 3, 4, 12 — submerged, floating, found along shallow sandy margins.

P. natans L. — 2, 3, 9, 11, 13 — submerged, floating, common in deep areas of lake and rivers.

P. Oakesianus Robbins — 2, 3, 4, 6 — submerged, floating, shallow areas along shore.

Najas flexilis (Willd.) Rostk. & Schmidt — 2, 9, 12, 13 — submerged, in rivers and lake.

Alisma trivale Pursh — 6 — emergent, rare, moist sandy shore.

Sagittaria graminea Michx. — 1, 9, 12 — submerged, emergent, common in shallow muddy areas.

S. latifolia Willd. forma *diversifolia* (Engelm.) Robinson — 6 — emergent, on river margin.

S. latifolia Willd. forma *hastata* (Pursh) Robins. — 3 — emergent, on sandy margin.

S. latifolia Willd. forma *gracilis* (Pursh) Robins. — 4, 6, 9, 13 — emergent, common, along sandy margins among rushes and sedges.

S. latifolia Willd. var. *obtusa* (Muhl.) Wieg. — 4 — emergent, common on shore of Station 4.

S. cuneata Sheldon — 6 — emergent, rare, on muddy shore.

Elodea Nuttallii (Planch.) St. John — 14 — floating, not abundant.

Calamogrostris canadensis (Michx.) Nutt. — 1, 2, 3 — emergent, on lake margin.

Panicum virgatum L. var. *spissum* Linder — 1 — emergent, along sandy shores often in dry as well as damp areas.

Cyperus dentatus Torr. — 9, 10, 12 — emergent, damp and dry margins.

C. strigosus L. — 10 — emergent damp and dry margins.

Dulichium arundinaceum (L.) Britt. — 1, 2, 4, 5, 7, 12 — emergent, common, found along sandy shores in conjunction with sedges and rushes.

Eleocharis acicularis (l.) R. & S. — 13, 14, 17 — submerged, common on muddy bottom.

E. obtusa (Willd.) Schultes — 6 — emergent, along sandy shore.
E. Smallii Britt. — 9 — emergent, along channel margin.
Scirpus Smithii Gray — 6 — emergent, rare, along sandy margin.
S. subterminalis Torr. — 4, 17 — submerged, river, lake bottom.
S. americanus Pers. — 1, 4 — emergent, on sandy margin.
S. atriovirens Willd. — 12 — emergent, on dry and damp shore.
S. Peckii Britt — 4 — emergent, rare, along sandy margin.
S. cyperinus L. forma *Andrewsii* (Fern.) Carpenter — 12 — emergent, damp shore.
S. cyperinus L. var. *pelius* Fern. — 1 — emergent, found among sedges and rushes.
Rhynchospora capitellata (Michx.) Vahl. — 12 — emergent, among sedges.
R. alba (L.) Vahl. — 12 — emergent, associated with sedges and rushes.
Cladium mariscoides (Muhl.) Torr. — 1, 4, 7 — emergent, common on south end of lake at Station 1.
Carex crinita Lam. — 10 — emergent, on dry sandy shore.
C. lurida Wahlenb. — 12 — emergent, on sandy margins.
C. rostrata Stokes — 2, 3 — emergent, in muddy meadows.
C. rostrata Stokes var. *utriculata* (Batt.) Bailey — 12 — emergent, on sandy margin.
C. oligosperma Michx. — 1 — emergent, sandy lake margins.
Peltandra virginica (L.) Schott & Endl. — 13 — emergent, common along muddy shore of Station 13.
Xyris caroliniana Walt. — 1, 4, 9 — emergent, common, with rushes and sedges on sandy shores.
X. montana Ries. — 1 — emergent, rare, lake margin among sedges.
Eriocaulon septangulare With. — 1, 4, 9 — emergent, submerged, common, along shore it is small, in deep water up to six feet in height.
Pontedaria cordata L. var. *cordata* — 1, 4, 7, 10, 12, 13, 14 — emergent, common along shore in shallow water.

P. cordata L. forma *angustifolium* (Pursh) Solms — 1 — emergent, in shallow water.

P. cordata L. forma *taenia* Fassett — 1, 4 — submerged, in shallow water.

Juncus canadensis J. Gay — 1, 9 — emergent, on sandy margin.

J. militaris Bigel. — 1, 4 — emergent, along sandy shore.

J. pelocarpus Meg. — 4, 9, 12 — emergent, in shallow water and on sandy shore.

Iris versicolor L. — 1 — emergent, on sandy shores.

Pogonia ophioglossoides (L.) Ker. — 1 — emergent, although not considered an aquatic, this bog plant was common in the small sphagnum area along the south shore lake margin.

Myrica Gale L. — 9, 10, 13, 14 — emergent, common, along lake and river edges often overhanging the water.

Polygonum amphibium L.[2] — 3 — floating, along muddy shores, often overhanging water.

P. amphibium L. forma *terrestre* (Leers) Blake — 2, 3 — emergent, in damp meadow along river shore.

P. coccineum Muhl. forma *natans* (Wieg.) Stanford — 3, 5 — floating, along muddy shore at Station 3 and in sand at Station 5.

P. hydropiperoides Michx. — 2, 13, 14 — submerged, floating emergent, along river edges and river bottoms in moving water.

P. sagittatum L. — 4 — emergent, not considered aquatic but found on sandy shore with other aquatics.

Ceratophyllum demersum L. — 13, 14 — submerged, in shallow, flowing water.

C. echinatum Gray — 3 — submerged, on muddy bottom in standing water.

Nuphar microphyllum (Pers.) Fern. — 2, 4 — submerged, floating, uncommon.

N. variegatum Engelm. — 1, 2, 4, 5, 7, 9, 11, 13, 14, 17 —

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[2]Mitchell (1968) considers *Polygonum coccineum* Muhl. and *P. amphibium* L. as the same species and has retained the name *P. amphibium* L.

submerged, floating very common, in one to six feet of water.

N. advena (Ait.) Ait. f. — near 4 — emergent, rare in muddy cove north of Bearcamp River in lake.

Nymphaea odorata Ait. — 1, 2, 3, 4, 5, 7, 9, 11, 13, 14, 17 — submerged, floating, very common, in one to six feet of water.

Brasenia Schreberi Gmel. — 4, 13, 14 — floating, in slow flowing water and protected areas.

Ranunculus trichophyllus Chaix — 3, 4 — submerged, in cold flowing water at Station 3 and on lake bottom in four feet of water at Station 4.

R. reptans L. — 1, 6, 17 — emergent, creeping along sand among reeds and sedges.

R. reptans L. var. *ovalis* (Bigel.) T. & G. — 13, 17 — emergent, along sandy margins.

Subularia aquatica L. — 4, 17 — submerged, uncommon, along sandy shore in one to two feet of water.

Cardamine pensylvanica Muhl. — 2, 13 — submerged, in slow flowing water.

Drosera intermedia Hayne — 1 — emergent, along margin with sedges and in sphagnum area.

Potentilla palustris (L.) Scop. — 2 — emergent, trailing into water from river bank.

Callitriche verna L. — 2, 3 — submerged, floating, in cold flowing water up to four feet in depth.

Hypericum punctatum Lam. — 1, 4 — emergent, along sandy margins.

H. ellipticum Hook. — 2, 6, 9, 12 — emergent, common, along sandy margins.

H. boreale (Britt.) Bickn. — 1 — emergent, along sandy margins.

H. boreale (Britt.) Bickn. forma *callitrichoides* Fassett — 2, 6, 12 — submerged, in sandy and muddy margins.

H. canadense L. — 9, 12 — emergent, along sandy margins.

H. virginicum L. — 1, 2, 4, 9 — emergent, common, on sandy shores and shallow water.

Elatine minima (Nutt.) Fisch. & Mey. — 4, 7, 12 — submerged, on sandy bottom in one to two feet of water.

Viola lanceolata L. — 9 — emergent, on grassy shore.
Rhexia virginica L. — 1 — emergent, on sandy margin among sedges.
Ludwigia palustris (L.) Ell. var. *americana* (D.C.) Fern. & Grisc. — 13 — submerged, on muddy bottom on slow flowing warm water.
L. palustris (L.) Ell. var. *americana* (D.C.) Fern. & Grisc. forma *elongata* — 14 — submerged, floating, in cold water.
Myriophyllum alternifolium D.C. — 14 — submerged, specimens found floating along surface after breaking loose.
M. Farwellii Morong — 13 — submerged, floating, some specimens floating just under surface along shore.
M. humile (Raf.) Morong forma *capillaceum* (Torr.) Fern. — 13 — on muddy river bottom.
M. tenellum Bigel. — 1 — submerged in deep water.
Proserpinaca palustris L. — 4 — submerged, rare on muddy bottom in swampy area between Meadow and Deer Cove.
P. pectinata Lam. — 1 — submerged, emergent, uncommon, with sphagnum moss and submerged along lake margin in six inches of water.
Sium suave Walt. — 3, 7, 13 — emergent, along damp shores and meadows.
S. suave Walt. forma *Carsoni* (Durand) Fassett — 2, 13, 14 — submerged, common in slow flowing rivers with muddy bottoms.
S. suave Walt. forma *fasciculatum* Fassett — 16 — submerged, rare, in shallow water in sand.
Chamaedaphne calyculata (L.) Moench — 4 — emergent, uncommon, along shore in sand.
Vaccinium macrocarpon Ait. — 1, 2, 4, 9, 16 — emergent, common, lake margin.
Lysimachia terrestris (L.) B.S.P. — 1, 2, 7, 12 — emergent, common, among sedges on lake margin.
L. ciliata L. — 6 — emergent, rare on damp shore.
Nymphoides cordata (Ell.) Fern. — 1, 2, 4, 7, 9, 11, 13, 15 — submerged, floating, usually in deep water up to eight feet.

Asclepias incarnata L. — 3, 13, 14 — emergent, along river and lake margins.
Scutellaria lateriflora L. — 2, 7, 12 — emergent, among grasses along river edge and along sandy shore.
S. epilobiifolia A. Hamilton — 1, 2, 4 — emergent, among grasses along river edge and along sandy shore.
Lycopus uniflorus Michx. — 4, 6 — emergent, along sandy margin.
L. americanus Muhl. — 5, 6 — emergent, along sandy margin.
Mentha spicata L. — 5 — emergent, rare, along river edge.
M. arvensis L. var. *arvensis* — 4, 6 — emergent, on sandy and muddy shore.
M. arvensis L. var. *villosa* (Benth.) S. R. Stewart — 6 — emergent, on muddy shore.
Chelone glabra L. var. *glabra* — 3, 12, 14 — emergent, along river shores and meadows.
Gratiola aurea Muhl. — 1, 4, 5, 7, 9, 13, 16 — emergent, common, on sandy margins.
G. aurea Muhl. forma *pusilla* Fassett — 1, 4, 5, 9 — submerged, in shallow water.
Lindernia anagallidea (Michx.) Pennell — 12 — emergent, uncommon sandy margin.
Veronica scutellata L. — 2, 12 — emergent, among grasses on sandy margins.
Utricularia purpurea Walt. — 3, 6, 11, 12, 13, 14, 15 — submerged, common, in areas with slow current.
U. inflata Walt. — 11, 12, 13, 14, 15, 16 — submerged, common, in slow current.
U. inflata Walt. var. *minor* Chapm. — 13 — submerged, uncommon, slow flowing water.
U. vulgaris L. — 3, 6, 13, 14 — submerged, in slow current.
U. intermedia Hayne — 6, 13, 14, 17 — submerged, along muddy shores in shallow water.
U. cornuta Michx. — 1, 9 — emergent, sandy margins among sedges.
Cephalanthus occidentalis L. — 2, 4, 6, 12, 13 — emergent, common, on sandy shores and along river edges.
Campanula aparinoides Pursh — 3, 7 — emergent, grassy shores.

Lobelia cardinalis L. — 3 — emergent, uncommon except along Branch Brook above station where it was abundant. Found on river shore.

L. Dortmanna L. — 4, 9 — emergent, submerged, along sandy margin.

Eupatorium dubium Willd. — 6 — emergent, on sandy shore.

E. maculatum L. — 6 — emergent, on sandy shore.

E. perfoliatum L. — 4, 7 — emergent, along lake margin among sedges.

Solidago graminifolia (L.) Salisb. — 2, 4 — emergent, along lake margin.

S. tenuifolia Pursh — 1, 2, 4 — emergent, along lake margin.

Aster Tradescanti L. — 2, 6, 7 — emergent, along sandy margin.

A. nemoralis Ait. — 10 — emergent, river margin.

A. umbellatus L. — 6, 7 — emergent, lake margin.

Bidens frondosa var. *pallida* Wieg. — 6 — emergent, muddy meadow.

Megalodonta Beckii (Torr.) Greene — 13, 14 — submerged, in slow current and muddy margins.

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